Benthic TMDL Development in the Smith River Watershed

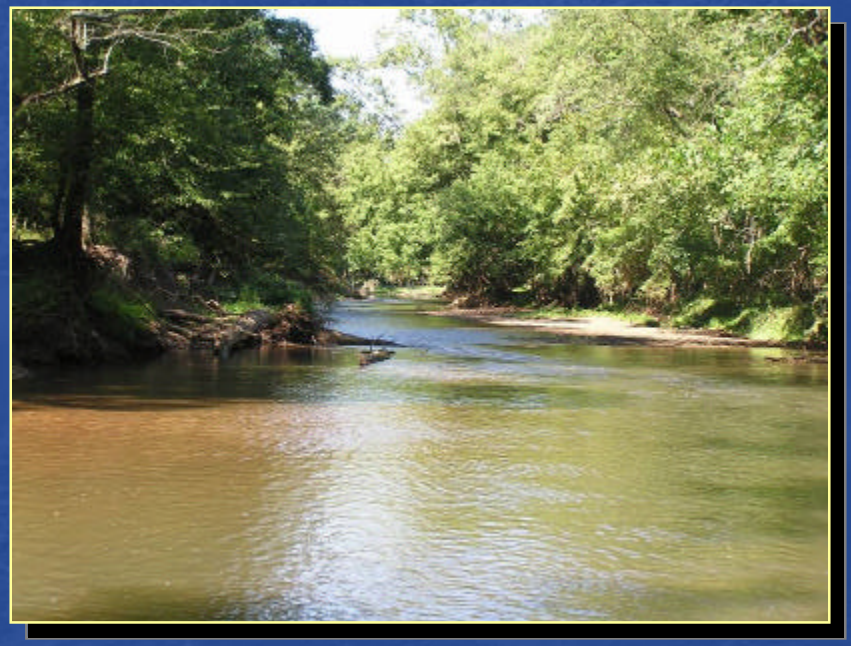
Public Meeting #2

March 29th, 2010

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

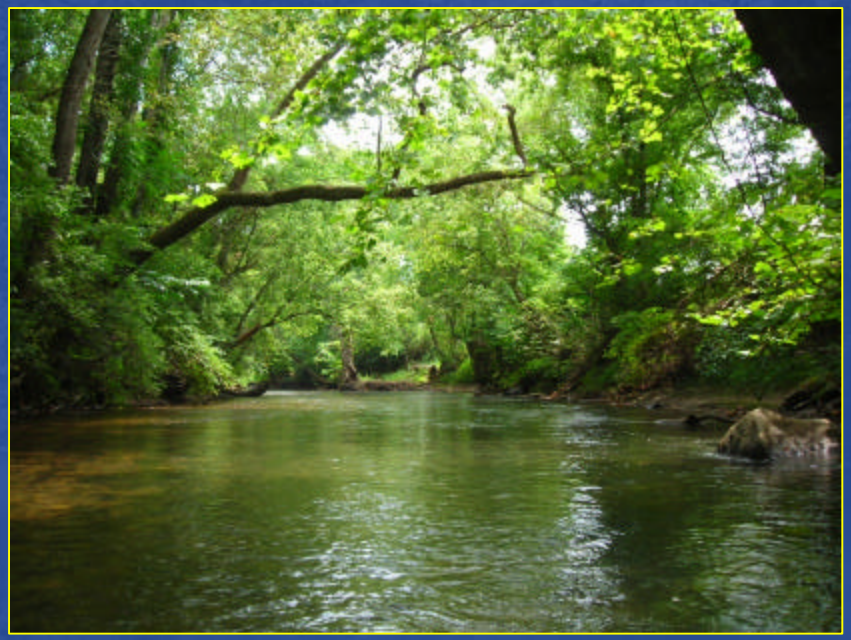
Agenda

- Smith River Benthic TMDL Meeting Agenda
  - Welcome and Introductions
  - Overview of Project
  - Stressor Analysis
  - Technical Approach
  - Benthic TMDL Allocations



Overview: Why are we here?

Smith River does not meet Virginia's Water Quality Standards.



- How do we know standards aren't being met?
- Why doesn't Smith River meet standards?
- What is being done to correct the problem?

How do we know that Smith River doesn't meet Water Quality Standards?

- Perform physical, biological, and chemical monitoring on water bodies throughout the state
- DEQ monitors parameters such as:

pH
Temperature
Dissolved Oxygen
Biological Community
Bacteria
Nutrients
Fish Tissue
Metals/Toxic Pollutants

What do we do with the monitoring data that is collected?

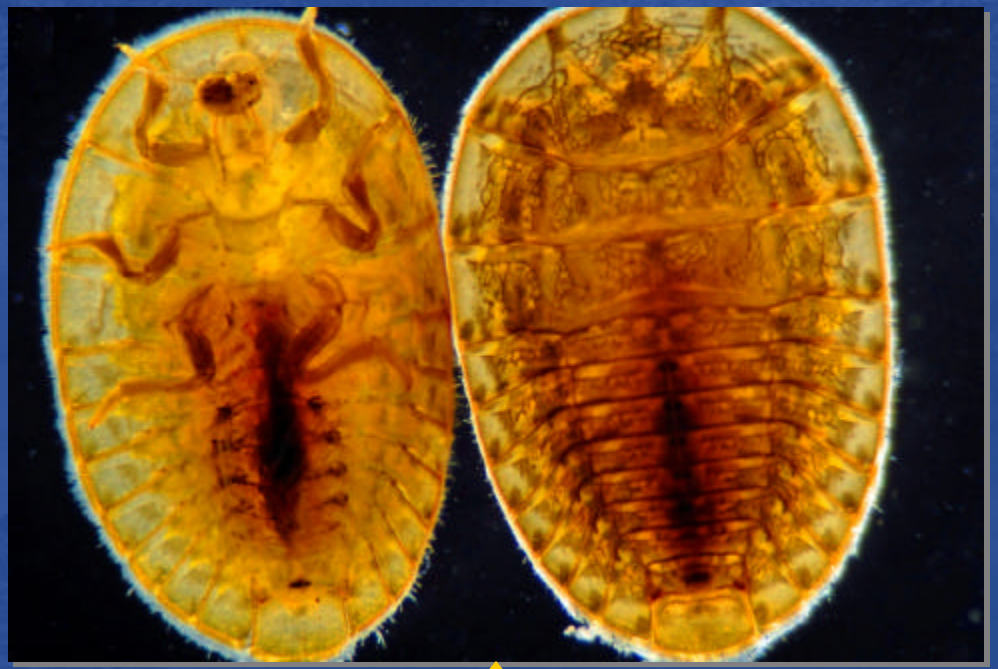
Compare the data collected to VA's Water Quality Standards

Water Quality Standards are:

- **Regulations based on federal and state law**
- **Numeric and narrative limits on pollutants**
- **Consist of designated use(s) and water quality criteria established to protect the designated uses**

Designated Uses

- Recreational
- Public Water Supply
- Wildlife
- Fish Consumption
- Shellfish
- Aquatic Life



The attainment of the aquatic life use is evaluated by testing for the health of the benthic macroinvertebrate community, as well as for parameters such as DO and pH.

What happens when a water body doesn't meet water quality standards?

- **Waterbody is listed as "impaired" and placed on VA's "Dirty Waters List" (303(d) list).**
- **Impaired waterbodies are scheduled for a Total Maximum Daily Load Study, or TMDL**
  - **TMDL Studies are required by law:**
    - **1972 Clean Water Act (CWA)**
    - **1997 Water Quality Monitoring Information and Restoration Act (WQMIRA)**

What is a TMDL?

TMDL = TOTAL MAXIMUM DAILY LOAD or The Amount of Pollution A Stream Can Receive and Still Meet Water Quality Standards

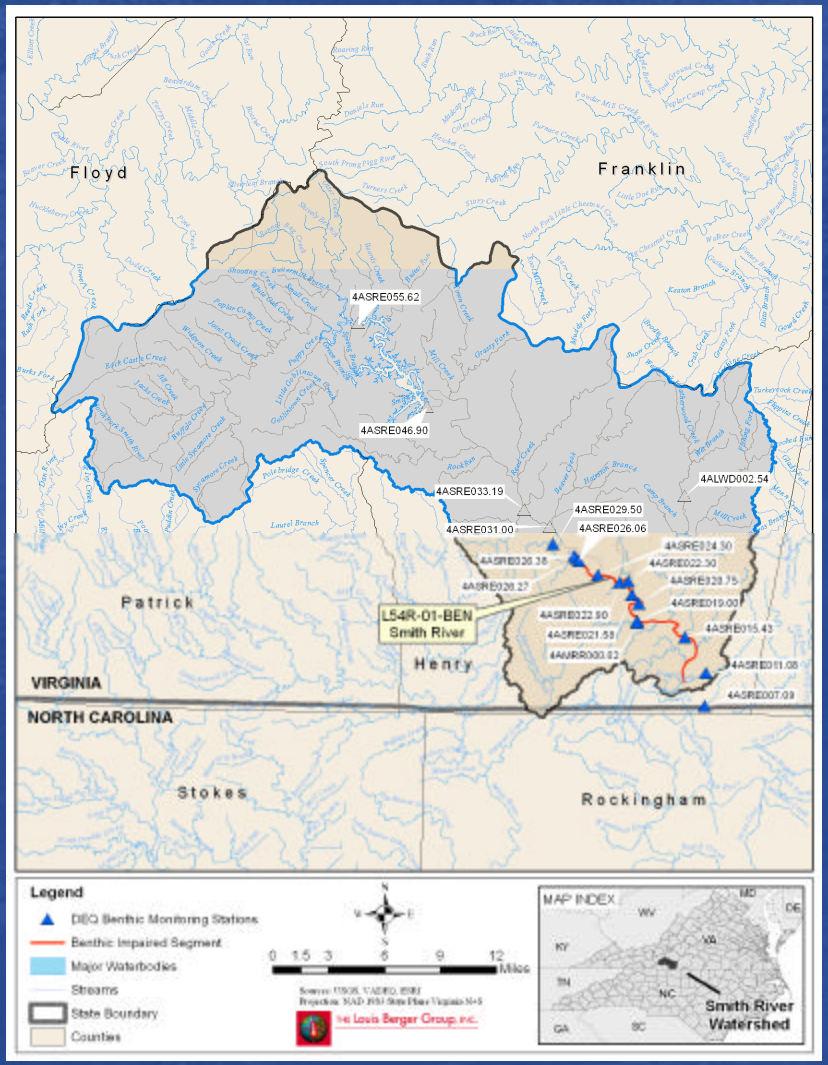
- **Identifies All Sources of Pollution**
  - **point sources (direct – industrial discharges, STPs)**
  - **non-point sources (indirect – runoff)**

- **Public participation!**

- **Uses available data and watershed models to…**
  - **Calculate the amount of a pollutant entering the waterbody from each source**
  - **Determine reductions in pollutants needed to attain / maintain Water Quality Standards**
  - **Assign Wasteload Allocations (WLAs)**

Smith River Impaired Segment

- **Segment L54R-01**
  - Listed on the 1998, 2002, 2004, and 2008 Section 303(d) Lists of Impaired Waters (VADEQ)
- **Upstream Limit:**
  - Martinsville Dam
- **Downstream Limit**
  - Confluence of the Smith River and Turkey Pen Branch
- **Total Length**
  - Approximately 14 Miles



VA DEQ 303(d) listing information is available on the VADEQ website: http://www.deq.virginia.gov/

Aquatic Life Use: What are benthic macroinvertebrates?

Pollution-Intolerant Invertebrates

Mayfly

Stonefly

Moderately Pollution- Tolerant Invertebrates

Water Penny

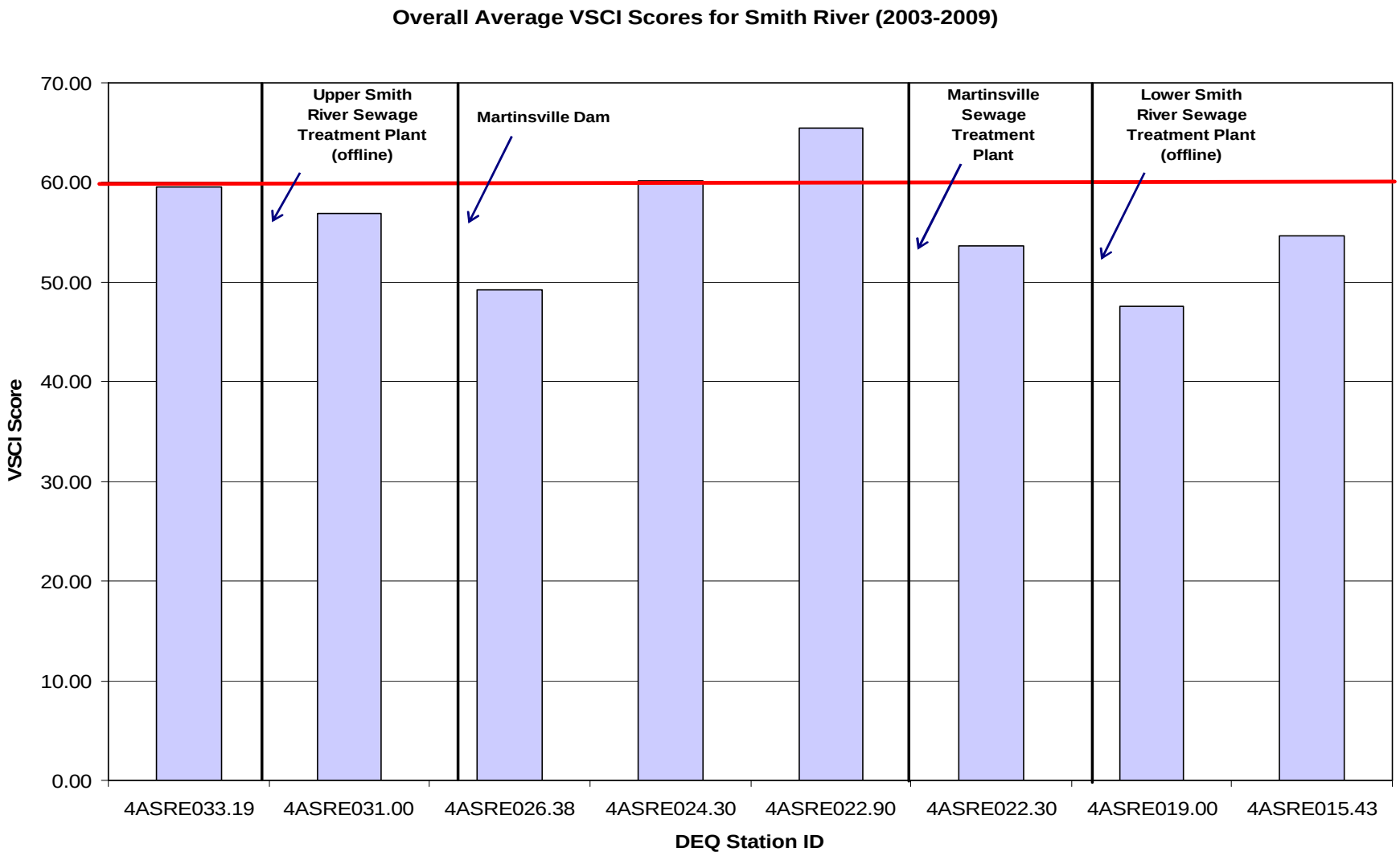
Net Spinning Caddisfly

Highly Pollution-Tolerant Invertebrates

Segmented Worm

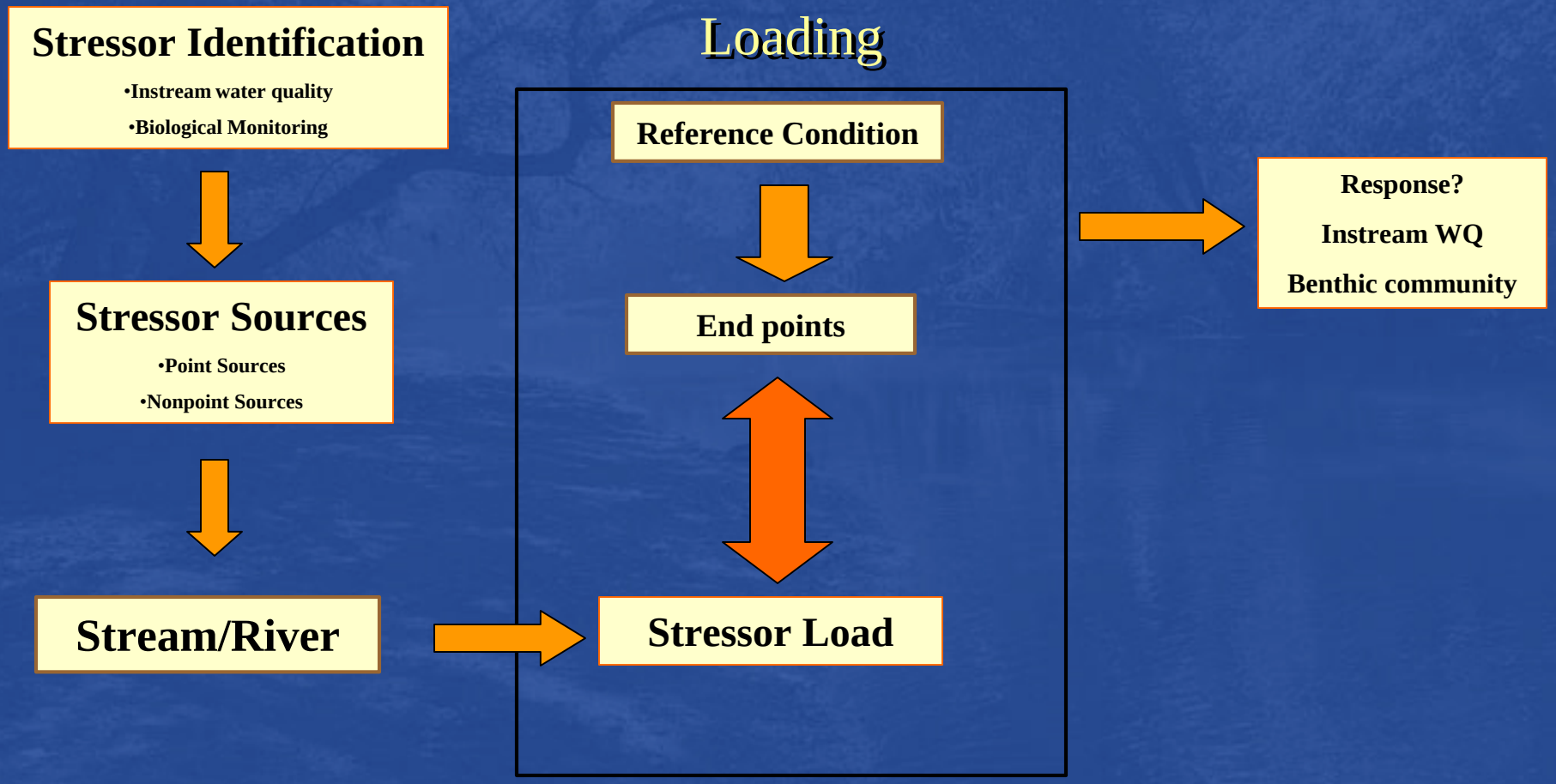
Leech

Benthic Macroinvertebrate Community Scores



Above the red line (VSCI = 60), station is considered unimpaired

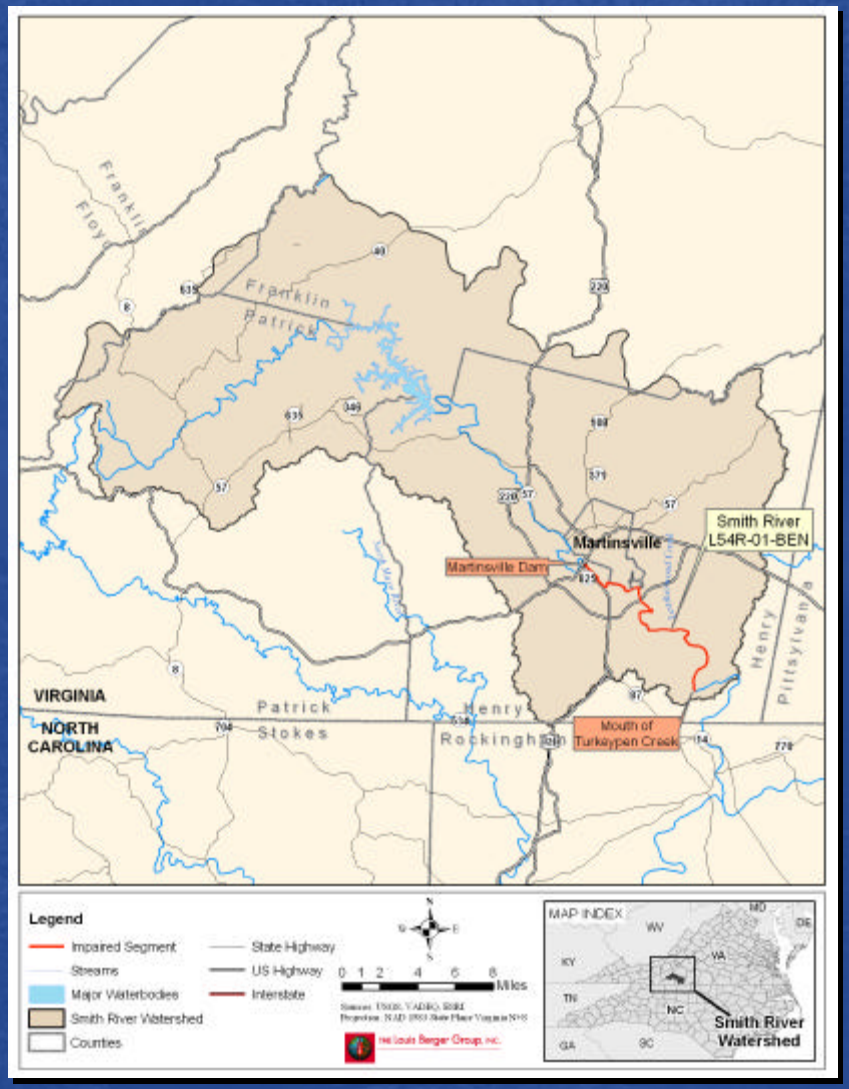
TMDL Process for Benthic Impairment



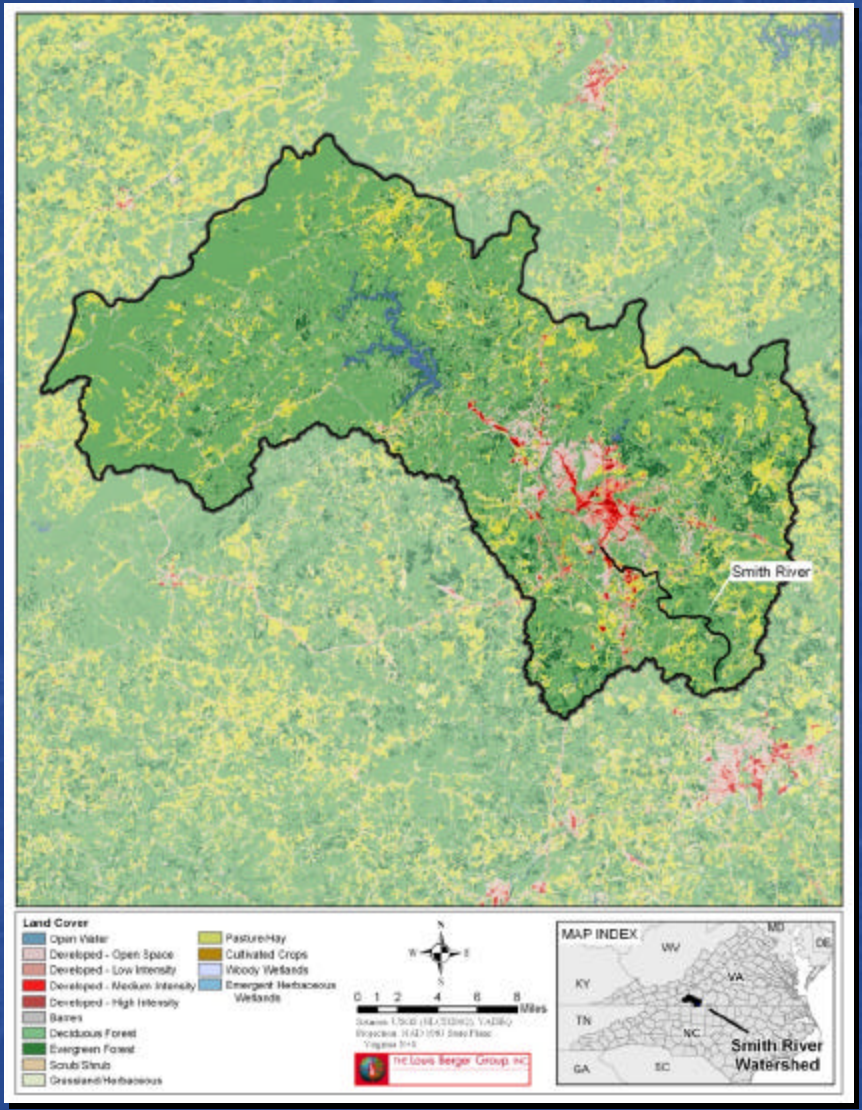
Watershed Characterization

Overview of Smith River Watershed

- Total Area: 529 mi^2
- Major tributary to the Dan River
- Flows through Henry, Patrick, Franklin and Floyd Counties



Smith River Land Use



- **Dominant Land Uses**
  - **Forest (76%)**
  - **Agriculture (11%)**
- **Non-Dominant Land Uses**
  - **Developed (8%)**
  - **Grassland/Shrub (3%)**
  - **Water/Wetlands (1%)**
  - **Barren (<1%)**

Permitted Facilities

Facilities Holding Individual Permits in the Smith River Watershed					
Permit No.	**Facility Name**	**Outfall No.**	**Design Flow (MGD)**	**Facility Type**	**Receiving Waterbody**
VA0086665	Bassett Mirror Company Incorporated	1	0.0035	Industrial	Town Creek
VA0029858	Carver Estates - Sewage Treatment Plant	1	0.06	Municipal	Grassy Creek
VA0072354	CPFilms Inc - Plant 1	1	4.2	Industrial	Smith River
VA0030660	DCR - Fairy Stone State Park	1	0.0005	Industrial	Hale Creek
VA0090174	Green Acres Mobile Home Park	1	0.01	Municipal	Tanyard Branch
VA0001554	Hanesbrands Incorporated	1	0.3881	Industrial	Smith River
VA0069345	Henry County PSA - Lower Smith River STP	1	4.0	Municipal	Smith River
VA0090280	Henry County Public SA - Greenbriar Lagoon STP	1	0.032	Municipal	Grassy Creek
VA0060445	Henry County Public SA - Piedmont Estates Lagoon	1	0.04	Municipal	Mill Creek
VA0025305	Martinsville City Sewage Treatment Plant	1	8.0	Municipal	Smith River
VA0090310	Philpott Dam Hydroelectric Plant	1	0.0638	Industrial	Smith River
VA0058441	Upper Smith River Water Filtration Plant	1	0.096	Industrial	Smith River, UT
VA0021989	Virginia Glass Products Corp	1	0.008	Industrial	Machine Branch, UT

Superfund and RCRA Sites

- ***Doyle Wood Treating Plant***
  - Federal registered superfund site (EPA ID # VA0000094490) located within the city of Martinsville
  - Abandoned wood treating plant which formerly ran a chromated copper arsenate process
  - Cleanup occurred from December 1993 to April 1996
- ***DuPont de Nemours & Co.***
  - Federally registered hazardous site (EPA ID# VAD003114865) that is regulated under the Resource Conservation and Recovery Act (RCRA)
  - Located upstream of the Martinsville Dam
  - 550 acres within a stream meander of the Smith River
  - Manufactured nylon between 1941 and 1988
  - Remediation and monitoring efforts have been occurring since 1986

Benthic Stressor Identification

- **What pollutant(s) is causing the impairment of the benthic community?**
- **Common Stressors include:**
  - Dissolved Oxygen
  - Nutrients
  - pH
  - Temperature
  - Sediment
  - Toxics
  - Flow Fluctuation

Data Used in Stressor Identification

Environmental Data:

1. Habitat Assessment and Biological Monitoring
2. Instream Ambient Water Quality
3. Flow Monitoring
4. Discharge Monitoring Reports (DMR)
5. Environmental Monitoring for Contaminants
    a) Fish Tissue
    b) Heavy Metals
    c) Organics
        - Water Column
        - Sediment
6. Toxicity Testing
    a) EPA chronic toxicity testing
    b) Whole Effluent Chronic Toxicity Testing (WET)

Stressor Identification

- Each candidate stressor was evaluated based on available monitoring data, field observations, and consideration of potential sources in the watershed
- Potential stressors were further classified as a *non-stressor*, *possible stressor*, or *most probable stressor*.

Classification of Stressors

- **Non-stressors:** The stressors with data indicating normal conditions and without water quality standard violations, or without any apparent impact
- **Possible stressors:** The stressors with data indicating possible links, however, with inconclusive data to show direct impact on the benthic community
- **Most probable stressor:** The stressor with the conclusive data linking it to the poorer benthic community

Non-Stressors

- **The following parameters are considered non-stressors:**
  - Heavy Metals in the Water Column
  - Dissolved Oxygen
  - pH
  - Chloride

Possible Stressors

- **Nutrients**
  - Total phosphorus (TP) levels were found to be relatively elevated downstream of wastewater treatment plants (average: 0.1 mg/L).
  - There are no VADEQ criteria for total nitrogen (TN). TN concentrations were generally low, ranging between 0.27 and 2.52 mg/L.

- **Sedimentation**
  - Evidence of sedimentation was found in habitat assessments and instream ambient water quality monitoring.
  - Elevated TSS levels, however, only occurred sporadically in the impaired segment. These occurrences did not correspond with high flow.
  - Results of 2008 quantitative habitat analysis (using EPA's Relative Bed Stability method) indicates that the Smith River is more stable at the downstream site (Rt. 636 bridge) and at the site just downstream of the Martinsville STP outfall than the reference site (Rt. 701 bridge, Fieldale)

Possible Stressors (continued)

- **Flow Fluctuation**
  - Flow fluctuations were found to directly respond to releases from the Philpott and Martinsville Dams during hydropower operation. This includes extremely low flow conditions downstream of the Martinsville Dam
  - Therefore, both dams have direct impacts on the flow regime within the impaired segment
  - No direct linkage can be established between the flow modification and the benthic community at this time due to the lack of data; however, it may have indirect impacts on the benthic community
- **Temperature Fluctuation**
  - Temperature fluctuations were found to be directly linked to flow releases from the Martinsville during hydropower operation .
  - Analysis of continuous temperature data (15 minute increments) measured downstream of Martinsville Dam, showed relatively high hourly temperature changes.
  - No direct linkage can be established between the flow modification and the benthic community at this time due to the lack of data; however, it may have indirect impacts on the benthic community

Therefore, nutrients, sedimentation, flow fluctuation , and temperature fluctuation are classified as possible stressors to the Smith River benthic community.

Most Probable Stressor

- **Toxicity**
  - Toxicity testing:
    - Instream toxicity testing by EPA
    - Whole Effluent Testing (WET) by several permitted dischargers
    - "Virtual Fish" data collected in 2003
- **Contaminants in Sediment**
  - Sediment sampling by VA DEQ (measured by EPA)

Toxicity Testing

- **EPA chronic toxicity testing:**
  - There were "biologically significant" adverse effects on fathead minnow survival and growth

- **Whole Effluent Acute Toxicity Testing (WET):**
  - Three facilities indicated had acutely toxic effluent between 1995 and 2006.
    - Bassett Mirror Company (VA0086665) showed acute toxic effluents in 2000-2002 and 2004. However, facility is located approximately 20 miles upstream from the benthic impaired segment.
    - Martinsville City Sewage Treatment Plant (VA0025305) showed acute toxic effluents only in March 1999.
    - Henry County Lower Smith River STP (VA0069345) showed acute toxic effluents from 1995 through 2004. However, facility is inactive.

    Note: Chronic WET testing was not completed for these three facilities

- **Sediment were tested for PCBs, Pesticides, and only PAH concentrations were consistently elevated in the samples**

PAH Sediment Exceedances

PAH: Polycyclic Aromatic Hydrocarbons are by-products of fossil fuel or biomass burning, oil spills, and resealed asphalt

Based on sediment samples collected by VA DEQ in 1997, 1999, 2002, and 2009

- **Benthic Impaired Segment:**
  - The Threshold Effect Concentration (TEC) was exceeded **17** times

- **Upstream of the Benthic Impaired Segment:**
  - The Threshold Effect Concentration (TEC) was exceeded **2** times

TEC is a sediment quality guideline criterion that identifies contaminant concentrations below which harmful effects on sediment dwelling organisms were not expected (MacDonald et al., 2000).

Stressor Identification Summary

Non-Stressors
Instream Dissolved Heavy Metals
DO
pH
Chloride
Possible Stressors
Nutrients
Sedimentation
Flow and Temperature Fluctuation
Most Probable Stressor
Toxicity: Organic Contaminants in Sediment (Total PAHs)

TMDL Endpoint and Technical Approach

- **VA DEQ selected the Threshold Effects Concentration (TEC) for Total PAH as the endpoint for the Smith River Benthic TMDL**
  - The TEC for total PAH is 1.61 mg/kg - This corresponds to the allowable concentration
  - **The most probable source for PAH in the watershed is urban runoff, based on organic composites ratios.**
  - **Existing Total PAH Concentration from urban runoff was estimated based on literature and simple mass balance model**
- **The allowable Total PAH load was based on the TEC**
  - **The difference between the existing and the allowable load is the required reduction for Total PAH**

Existing PAH Load and Required Reduction

- Existing PAH Load: 62 kg/year or 0.17 kg/day
- Allowable PAH Load: 44 kg/year or 0.12 kg/day
- Required PAH Reduction: 29%

Allocations for the Smith River

- No WLA, since permitted point source dischargers in the watershed are not a source for Total PAH

- Total allowable load is allocated to LA (urban non-point sources):

Source (kg/day)	Existing Total PAH (kg/day)	Allocated Total (kg/day)	Percent Reduction
Urban Land (Low, medium, high intensity, open space)	0.17	0.12	29%

Overall Recommended TMDL Allocations

- No WLA, since permitted point source dischargers in the watershed are not a source for Total PAH
- Total allowable load is allocated to LA (urban non-point sources)
- Implicit MOS : Implicitly incorporating the MOS requires that allocations meet the Threshold Effect Concentration of 1.61 mg/kg (44 kg/year) at any time.

WLA (Wasteload Allocation) (kg/day)	LA (Load Allocation) (kg/day)	MOS (Margin of Safety)	TMDL (kg/day)
0	0.12	Implicit	0.12

Next Steps

- 30 Day Comment Period – ends April 28, 2010
- Phased TMDL Report
- TMDL Report posted on DEQ's website:
  https://www.deq.virginia.gov/TMDLDataSearch/DraftReports.jspx
- Additional DEQ monitoring – biomonitoring, water column toxicity testing ($$$ permitting); assess flow and temperature linkage to benthic impairment
- Meet with Steering Committee following additional data collection
- Complete TMDL, modify if necessary, and submit final phase of TMDL to EPA for approval

Local TMDL Contacts

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Presentation available at:
www.deq.virginia.gov/tmdl/mtgppt.html

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